HOT INTERSTELLAR GAS AND IONIZATION OF EMBEDDED CLOUDS

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We present detailed photoionization calculations for the interstellar cloud in which the Sun is embedded. We consider the EUV radiation field with contribution from discrete stellar sources and from a thermal bremsstrahlung-radiative recombination spectrum emitted from the surrounding 10^6 k coronal substrate. We establish lower limits to the fractional ionization of hydrogen and helium of 0.17 and 0.29 respectively. The high He ionization fraction results primarily from very strong line emission below 500 A originating in the surrounding coronal substrate while the H ionization is dominated by the EUV radiation from the discrete stellar sources. The dual effects of thermal conduction and the EUV spectrum of the 10^6 K plasma on ionization in the cloud skin are explored. The EUV radiation field and Auger ionization have insignificant effects on the resulting ionic column densities of Si IV, C IV, N V and O VI through the cloud skin. Our calculations show that the abundances of these species are dominated by collisional ionization in the thermal conduction front. Because of a low charge exchange rate with hydrogen, the ionic column density ratios of N(C III)/N(C II) and N(N II)/N(N I) are dominated by the EUV radiation field in the local interstellar medium. These ratios should be important diagnostics for the EUV radiation field and serve as surrogate indicators of the interstellar He and H ionization fraction respectively. Spacecraft such as Lyman which is designed to obtain high resolution spectral data down to the Lyman limit at 912 A could sample interstellar lines of these ions.

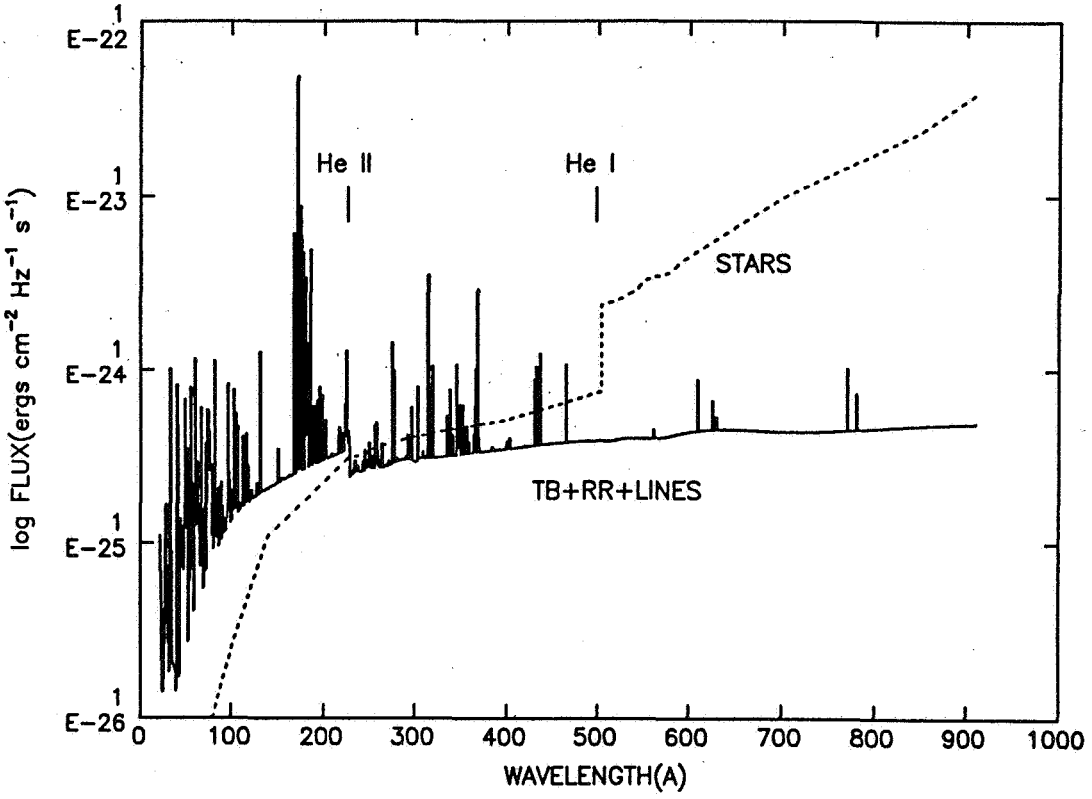

Fig. 1 - Unattenuated EUV flux distributions of the diffuse and discrete sources. The curve labeled "STARS" indicates the contribution from the dominant stellar sources. The diffuse X-ray background flux from the 10^6 K gas is represented by the sum of three components: thermal bremsstrahlung, radiative recombination, and line emission. This is represented by the curve labeled "TB+RR+LINES". The important emission lines are summed into 1 A bins. The ionization edges of He I (504 A) and He II (228 A) are indicated.